REMARKS

Claims 1-14 are pending in this application. Claims 1-10 have been amended. New Claims 11-14 have been added. Support for the amendments and new claims is found in the specification and claims as filed. Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Claim Rejections - 35 U.S.C. § 112, second paragraph

Claims 1-10 have been rejected under 35 U.S.C. §112, second paragraph. Claims 1-10 have been amended to clarify that a method is claimed. The term "organic polymer film" has proper antecedent basis. In view of the foregoing amendments, Applicants respectfully request withdrawal of the rejections of Claims 1-10.

Obviousness-Type Double Patenting Rejection

The Examiner has rejected Claims 1-10 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-12 of U.S. Patent No. 6,245,489. Applicants herewith submit a terminal disclaimer to overcome this rejection.

Claim Rejection - 35 U.S.C. § 102(b)

Claims 1-10 have been rejected under 35 U.S.C. §102(b) as anticipated by U.S. 5,110,712 (hereinafter "Kessler et al."). "A rejection for anticipation under section 102 requires that each and every limitation of the claimed invention be disclosed in a single prior art reference." *See, e.g., In re Paulsen*, 31 U.S.P.Q.2d 1671 (Fed. Cir. 1994). Kessler et al. does not disclose every element of Applicants' claims, and therefore cannot be considered as an anticipating reference under 35 U.S.C. § 102(b).

Independent Claim 1 recites a method for forming a patterned hard mask layer in an organic polymer film for an interconnect structure in an integrated circuit "wherein at least a part of said hard mask layer is retained as a dielectric layer." Independent Claim 7 recites a method for patterning an organic polymer film for an interconnect structure in an integrated circuit "wherein at least a part of said fluorinated part is retained as a dielectric layer." The hard mask layer or fluorinated part refer to a fluorinated organic polymer film.

Kessler et al. does not disclose a fluorinated organic polymer film retained as a dielectric layer. Instead, Kessler et al. discloses the use of an inorganic layer as a hard mask for patterning an organic polymer. The inorganic layer, which forms a permanent part of a dielectric layer in a

semiconductor device, is patterned using a resist mask as a pattern mask, which is later removed. The inorganic layer can be formed of silicon dioxide or silicon nitride.

In Kessler et al., the second inorganic layer (inorganic mask 30 in Fig. 4 of Kessler et al.) must remain in the device because it must help to relieve stress in the device, serve as a masking layer during etching of the polymer (polymer 20 in Fig. 4 of Kessler et al.), and cannot be removed because the first inorganic layer (inorganic layer 14 in Fig. 4 of Kessler et al.), exposed at the bottom of the via (via 34 in Fig. 3 of Kessler et al.), would also be removed. This inorganic layer, i.e. silicon dioxide or silicon nitride, is a dielectric layer, but it does not have a low dielectric constant as does the fluorinated organic polymer film as recited in the pending claims. The problem with using such inorganic dielectrics as mask materials if they are to remain in the device is explained in the "Background of the Invention" portion of the specification of the present application at page 2, line 18 to page 3, line 3. The differences in dielectric properties between inorganic layers and low-k dielectrics is one of the driving forces behind the development of these low-k dielectric materials, which are a prerequisite to sub-micron technologies solving the problem of capacitive coupling between interconnect lines. For this reason, the pending claims recite removing the second hard mask layer once the fluorinated layer is patterned.

Thus Kessler et al. does not disclose a limitation of the pending claims, and therefore cannot anticipate Claims 1 and 7 and their corresponding dependent claims. Accordingly, Applicants respectfully request that the anticipation rejection of Claims 1-10 be withdrawn.

CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is in condition for allowance. Should the Examiner have any remaining concerns which might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the telephone number below.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 8/8/02

By: _____

Rose M. Thiessen
Registration No. 40,202
Attorney of Record
620 Newport Center Drive
Sixteenth Floor
Newport Beach, CA 92660

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Deleted text is indicated by **[bracketed boldface]**. Added text is indicated by **underlined boldface**.

IN THE CLAIMS:

Claims 1-10 have been amended as follows:

1. (Amended) **[An integrated circuit comprising an interconnect structure, wherein a process of forming said interconnect structure comprises a]** **A** method for forming a patterned hard mask layer in an organic polymer film **for an interconnect structure in an integrated circuit**, said method comprising**[the steps of]**:

fluorinating a part of **[the]** **an** organic polymer film, thereby forming a fluorinated part, said fluorinated part forming a first hard mask layer;

forming a patterned second hard mask layer on said film;

patterning said first hard mask layer using said patterned second hard mask layer as a mask, thereby **[foring]** **forming** a patterned first hard mask layer;

removing said second hard mask layer; and

etching said organic polymer film using said patterned first hard mask layer as a mask, wherein at least a part of said first hard mask layer is retained as a dielectric layer.

2. (Amended) The **[integrated circuit]** **method** as recited in Claim 1, wherein said organic polymer film comprises an organic polymer having at least one phenyl group.

3. (Amended) The **[integrated circuit]** **method** as recited in Claim 2, wherein said organic polymer film is selected from the group consisting of benzocyclobutarenes, poly arylene ether, aromatic hydrocarbon, and polyimides.

4. (Amended) The **[integrated circuit]** **method** as recited in Claim 1, wherein the fluorinating step is performed in an ambient comprising fluorine without substantially changing the thickness of said organic polymer layer.

5. (Amended) The **[integrated circuit]** **method** as recited in Claim 4, wherein said fluorine is generated from a source selected from the group consisting of NF_3, SF_6, ClF_3, F_2, XeF_2, and C_xF_y, with x and y being positive whole numbers greater than zero.

6. (Amended) The **[integrated circuit]** **method** as recited in Claim 1, wherein said second hard mask layer is selected from the group consisting of oxides, nitrides and oxynitrides.

7. (Amended) **[An integrated circuit comprising an interconnect structure, wherein a process of forming said interconnect structure comprises a]** **A** method for patterning an organic polymer **[layer]** **film for an interconnect structure in an integrated circuit**, said method comprising**[the steps of]**:

defining at least one first region and at least one second region in an organic polymer film formed on a substrate, said first region being uncovered and said second region being covered with a layer forming a diffusion barrier for fluorine;

exposing said first and said second region to an ambient comprising fluorine resulting in the fluorination of at least a part of said first region, thereby forming a fluorinated part;

removing said layer; and

selectively removing at least a part of said second region by etching, using said first region as a mask, wherein at least a part of said fluorinated part is retained as a dielectric layer.

8. (Amended) The **[integrated circuit]** **method** as recited in Claim 7, wherein said organic polymer film comprises an organic polymer having at least one phenyl group.

9. (Amended) The **[integrated circuit]** **method** as recited in Claim 8, wherein said organic polymer is selected from the group consisting of benzocyclobutarenes, poly arylene ether, aromatic hydrocarbon, and polyimides.

10. (Amended) The **[integrated circuit]** **method** as recited in Claim 7, wherein said layer forming a diffusion barrier for fluorine is selected from the group consisting of resists, oxides, nitrides and oxynitrides.

New Claims 11-14 have been added:

11. (New) An integrated circuit comprising an interconnect structure, said interconnect structure comprising a dielectric layer, said dielectric layer comprising at least a portion of a hard mask layer, the hard mask layer comprising a patterned organic polymer film wherein a portion of the patterned organic polymer film is fluorinated.

12. (New) The integrated circuit as recited in Claim 11, wherein the patterned organic polymer film is a patterned low-K organic polymer film.

13. (New) The integrated circuit as recited in Claim 11, wherein the patterned organic polymer film comprises a surface and an interior, wherein the surface comprises a fluorinated portion and the interior comprises a non-fluorinated portion.

14. (New) The integrated circuit as recited in Claim 13, wherein a K value of the fluorinated portion is less than a K value of the non-fluorinated portion.

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